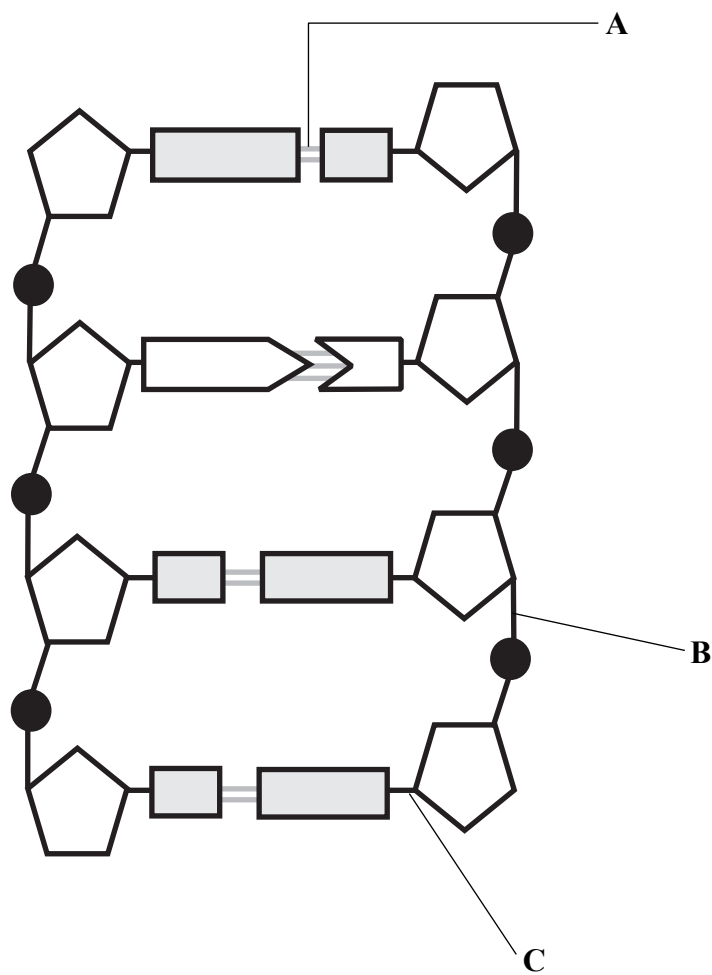


Answer ALL questions in the spaces provided.

1. The diagram below shows a section of human DNA.



(a) Draw a circle around **one** nucleotide on the diagram above.

(1)

(b) The letters **A**, **B** and **C** represent bonds.

(i) Name the type of bond labelled **A**.

..... (1)



Leave
blank

(ii) Give the letter which represents the bond that did **not** form by a condensation reaction.

.....
(1)

(c) Name **two** components of DNA, other than the bases.

1

2

(2)

(d) The table below shows the percentage of thymine found in a sample of human DNA. Complete the table by adding the **names** of the three missing bases and their percentages.

Base	Percentage found in a sample of human DNA
Thymine	36
Total	100

(2)

Q1

(Total 7 marks)



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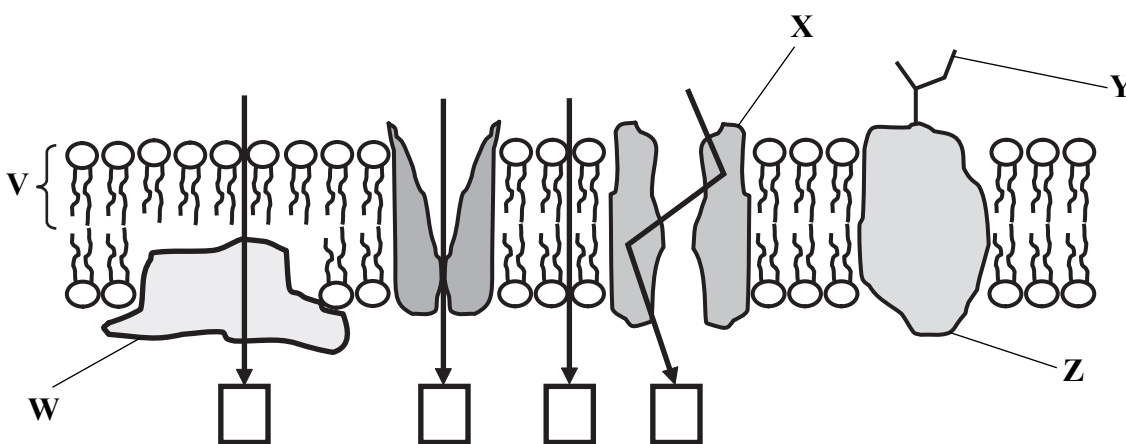


2. Oxygen is absorbed across the gas exchange surface of the lungs and enters the bloodstream.

(a) Name the site of gas exchange in the lungs.

.....
(1)

(b) The gas exchange surface of the lungs consists of cells. The diagram below shows the fluid mosaic model of the surface membrane from one of these cells.



(i) Place a tick in the box below the arrow on the diagram that represents the main way oxygen diffuses into the cell.
(1)

(ii) Name the structure labelled Y on the diagram.
.....
(1)

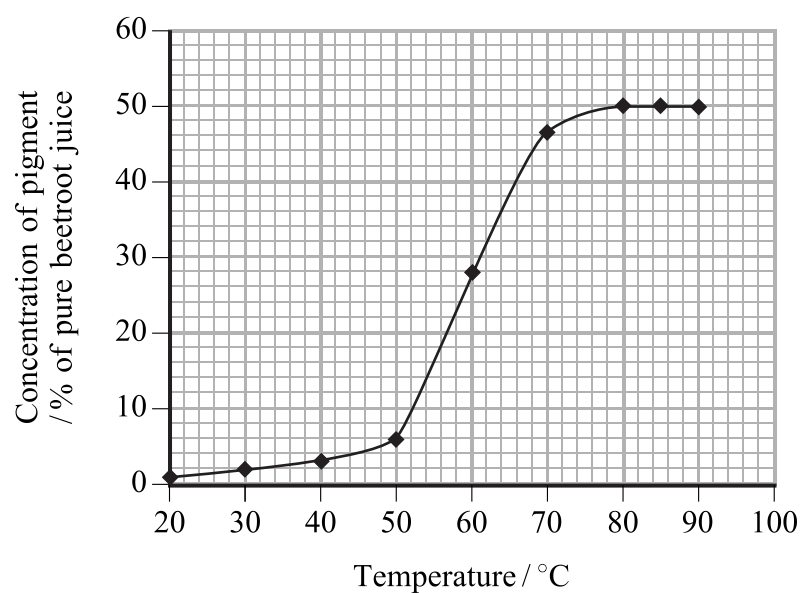
(iii) Give the letter of the component that represents the fluid part of the fluid mosaic model.
.....
(1)



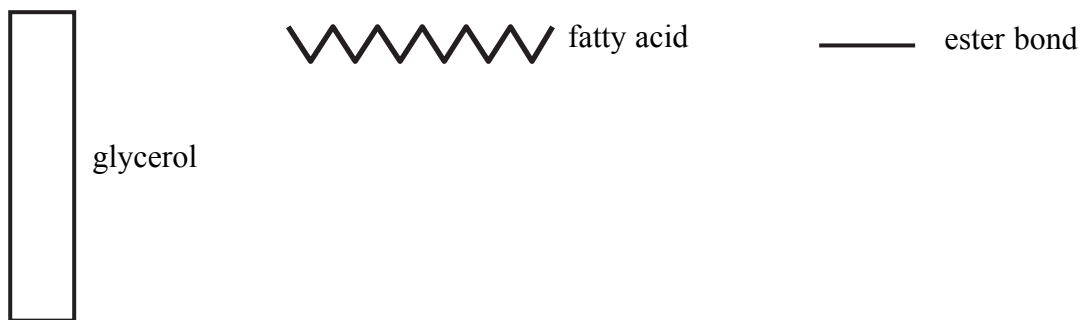
(c) A student used raw beetroot to investigate the effect of temperature on membrane structure.

He cut nine equal-sized pieces of beetroot and washed them to remove any purple-red pigment released during the cutting process. He placed one beetroot piece in a test tube with 10 cm³ water at 20 °C. After 5 minutes, he removed the beetroot piece. He measured the concentration of pigment in the water as a percentage of pure beetroot juice.

The procedure was repeated with the other beetroot pieces at eight different temperatures. The results are shown in the graph below.



3. (a) In the space below, draw a triglyceride. You may use any component more than once.



(3)

(b) There are four statements about triglycerides given below. If the statement is correct put a tick (✓) in the box to the right of that statement and if the statement is incorrect put a cross (✗) in the box.

Statement	Tick (✓) or cross (✗)
Triglycerides are building blocks of polysaccharides	
Triglycerides can contain a small amount of nitrogen	
Triglycerides can be modified into phospholipids	
Triglycerides release water during hydrolysis	

(4)



(c) Fatty acids can be either saturated or unsaturated. Explain what is meant by the term **saturated** fatty acid.

.....
.....

(1)

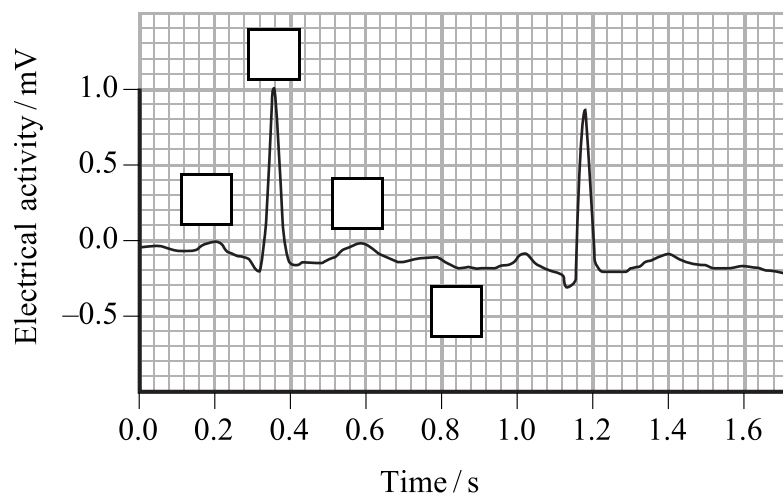
(Total 8 marks)

Leave
blank

Q3



4. (a) The electrocardiogram (ECG) below shows the normal electrical activity of the heart measured at the body surface.



- (i) Place a tick (✓) in the box on the ECG that shows electrical activity of the sino-atrial node (SAN). (1)
- (ii) Use the ECG above to calculate the heart rate in beats per minute. Show your working.

Answer: beats per minute
(2)

- (iii) Suggest a likely difference in the ECG shown above if the person being tested had recently had a caffeine-rich drink.

.....

(1)



Leave
blank

(b) Blockage of a coronary vessel can lead to the death of the cardiac muscle cells. This knowledge has been applied in a medical technique called embolisation that can be used for the treatment of tumours (uncontrolled growths of cells).

In embolisation, an inert substance is injected into an artery that supplies blood to a tumour. The substance fully blocks that artery.

Suggest how embolisation helps to destroy a tumour.

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(2)

Q4

(Total 6 marks)



5. Beta (β) thalassaemia is a rare, but serious, genetic condition. It is caused by a recessive allele of a gene that codes for one of the components of haemoglobin. Some people are carriers of β -thalassaemia.

(a) Explain the term **carrier**.

.....

.....

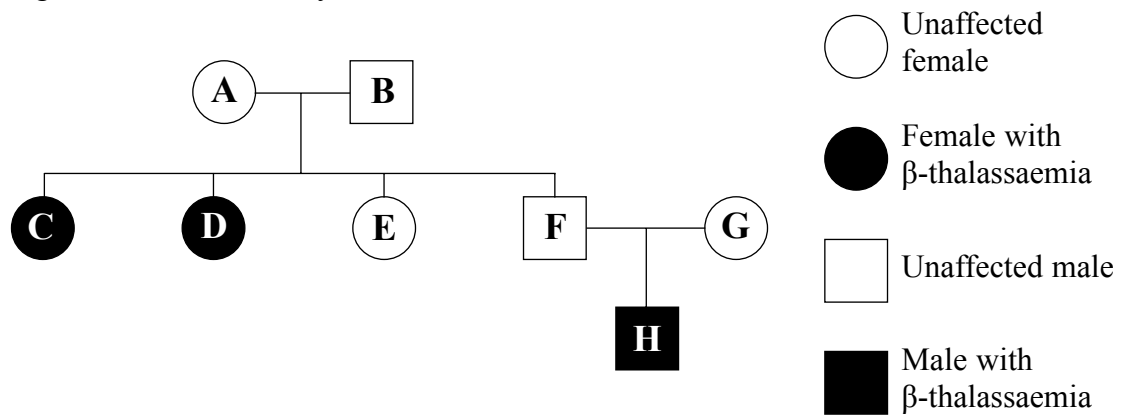
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.....

(2)

(b) The pedigree diagram below shows the inheritance of β -thalassaemia over three generations of a family.



(i) Using the pedigree diagram, state the number of female children couple **A** and **B** had.

.....

(1)

(ii) By means of a **genetic diagram**, explain why child **D** has β -thalassaemia.

(3)



Leave
blank

(iii) Give evidence to show that person **G** is heterozygous for β -thalassaemia.

.....
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.....
.....
.....
.....

(2)

(c) The National Health Service (NHS) provides genetic counselling to couples where both partners are carriers of β -thalassaemia and are thinking of trying for a baby. If the woman becomes pregnant, the NHS will offer chorionic villus sampling (CVS) to allow the couple to make an informed choice about the pregnancy.

(i) The counsellor will tell the couple the probability that their child will have β -thalassaemia. State this probability.

.....

(1)

(ii) Discuss the issues that these carrier couples might consider when deciding whether or not to have CVS.

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(2)

(Total 11 marks)

Q5

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6. (a) Cystic fibrosis is a recessive inherited condition that can affect the functioning of the reproductive system. Describe the effect of cystic fibrosis on the **male** reproductive system.

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(3)

(b) Two DNA template sequences are given below, along with a number reference. Sequence P comes from a person without cystic fibrosis and sequence Q comes from a person with cystic fibrosis. ~~T~~ represents a deleted thymine base.

Number reference	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sequence P (unaffected)	A	T	C	A	T	C	T	T	T	G	G	T	G	T	T
Sequence Q (cystic fibrosis)	A	T	C	A	T	T	T	T	T	G	T	T	G	T	T



Leave
blank

(i) One of the differences between the two sequences is the deletion of three thymine (T) bases in sequence Q, as shown by ~~T~~ ~~T~~ ~~T~~. State **two** other differences between sequence P and sequence Q.

1

.....

2

.....

(1)

(ii) In gel electrophoresis, a gene probe would be used to detect the presence of sequence Q. Give the DNA sequence of the gene probe suitable for detecting sequence Q.

.....

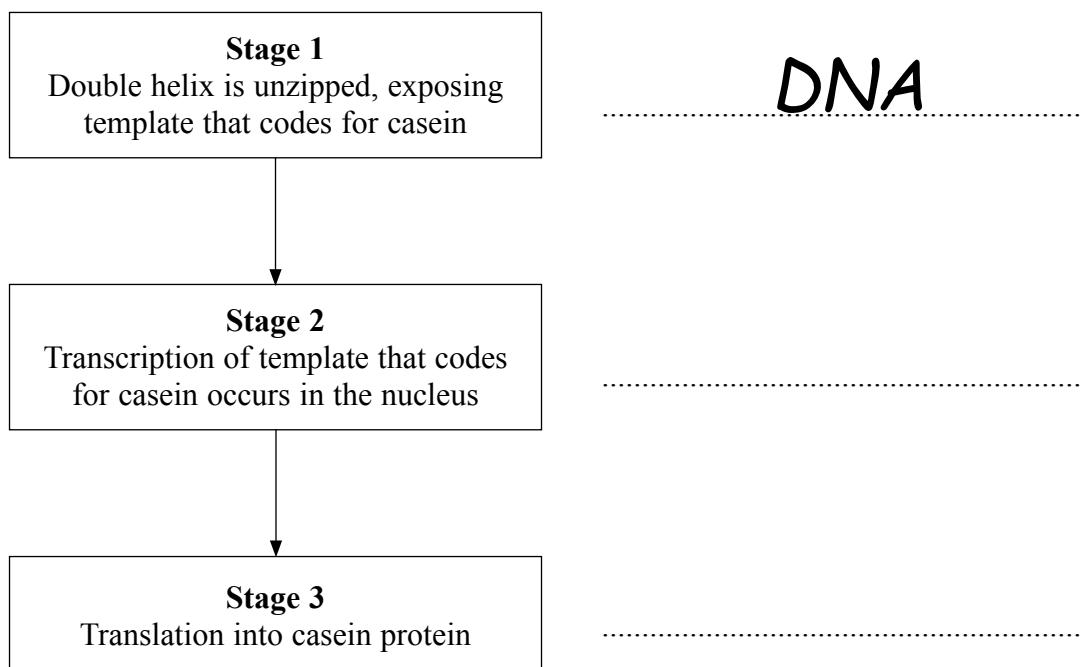
(1)

Q6

(Total 5 marks)



(c) The main protein in yoghurt is casein. The synthesis of casein in cells is shown in the diagram below.



(i) At each stage, one or more nucleic acids is involved. Give the nucleic acid or nucleic acids involved at each stage on the dotted line next to the box. The first one has been done for you.

(4)

(ii) Name the site within a cell where stage 3 occurs.

.....

(1)

Q7

(Total 12 marks)

TOTAL FOR PAPER: 60 MARKS

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N 3 4 2 8 5 A 0 1 9 2 0

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